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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	1151
First Inventor or Application Identifier	Kishan B. Shah
Title	METHOD AND APPARATUS FOR EFFICIENT DETERMINATION OF RECOGNITION PARAMETERS
Express Mail Label No.	EL528759599US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent applicaiton contents.

ADDRESS TO: **Assistant Commissioner for Patents, Box Patent Application, Washington, DC 20231**

1. [X] * Fee Transmittal Form (e.g., PTO/SB/17) *(Submit an original, and a duplicate for fee processing)*
2. [X] Specification [*Total Pages* 28] *(preferred arrangement set forth below)*
   - Descriptive title of the Invention
   - Cross References to Related Applications
   - Statement Regarding Fed sponsored R & D
   - Reference to Microfiche Appendix
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (if filed)
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure
3. [X] Drawing(s) (35 U.S.C. 113) [*Total Sheets* 3]
4. Oath or Declaration [*Total Pages* 3]
   a. [X] Newly executed (original or copy)
   b. [ ] Copy from a prior application (37 C.F.R. § 1.63(d)) *(for continuation/divisional with Box 17 completed)* ***[Note Box 5 below]***
      i. [ ] DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).
5. [ ] Incorporation By Reference (useable if Box 4b is checked) The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered to be part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. [ ] Microfiche Computer Program *(Appendix)*
7. Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all necessary)*
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8. [X] Assignment Papers (cover sheet & documents)
9. [ ] 37 C.F.R.§3.73(b) Statement *(when there is an assignee)* [ ] Power of Attorney
10. [ ] English Translation Document *(if applicable)*
11. [ ] Information Disclosure Statement (IDS)/PTO-1449 [ ] Copies of IDS Citations
12. [ ] Preliminary Amendment
13. [X] Return Receipt Postcard (MPEP 503) *(Should be specifically itemized)*
14. [ ] * Small Entity Statement(s) *(PTO/SB/09-12)* [ ] Statement filed in prior application, Status still proper and desired
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17. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in a preliminary amendment:*

[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No _____

Prior application information: Examiner _____ *Group / Art Unit* _____

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Signature	Charles E. Gotlieb	*Date*	August 7, 2000

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METHOD AND APPARATUS FOR EFFICIENT DETERMINATION OF RECOGNITION PARAMETERS

Attorney Docket Number

1151

Express Mail Label Number

EL528759599US

Inventor

Kishan B. Shah

Field of the Invention

The present invention is related to computer software and more specifically to computer software for optical recognition of objects.

Background of the Invention

Computer software can be used to recognize digital representations of objects. For example, optical character recognition software can be used to recognize digital representations of character objects, typically obtained by scanning a printed page, segmenting the page into characters, and identifying characteristics of each character. Rules are used to narrow the choice of characters to a smaller range of characters, and a confidence level is assigned to each character in the

smaller range. The character with the highest confidence level may be selected as the recognized character.

Some computer software for object recognition uses parameters to allow the software to be adjusted. The use of parameters allows the software to be tuned in a laboratory to particular conditions simulating the environment of anticipated operation of the software. Before the software is shipped as part of a product, the parameters are fixed at a constant level that yielded the optimum recognition in the laboratory simulation for that product.

For example, if a scanned image represents the image using pixels, each having a greyscale value of 0-255, one parameter of the optical character recognition software may be to identify which values correspond to a part of the image to be recognized, in order to distinguish that part of the document from the greyscale value of the background. For example, a document received via a fax that is photocopied onto off-white paper may have text that has a greyscale reading of 200, while the remainder of the page may have a greyscale reading of 100. A printed black and white document may have a greyscale reading of 240 for text and 30 for the remainder of the page. Text on a printed

color document may have a greyscale reading as low as 90 with a greyscale reading of 70 for portions of the background. These various values may be used to determine that an optimal cutoff greyscale reading of 150 should be used for the software. While this value provides a good compromise for high-contrast documents such as most black and white documents, certain color text on color background documents simply will not be recognized with this parameter value. If the parameter were lowered to 80 to accommodate recognition of color documents, some black and white documents would not be recognized, such as the fax photocopied onto off white paper.

It would be desirable to have the parameter selection process vary for each set of objects, such as characters on the page, rather than selecting a single value for each parameter and using that same value for all objects. This would allow the parameter values to change for every page or part of a page, causing the parameters to be optimized for every circumstance. In the example above, it would be desirable to use a greyscale threshold of 150 for the faxed document and a threshold of 80 for the color document, instead of using a value of 150 every time.

While it is possible to make several attempts at recognizing the objects, such as characters in the file, using different parameters for each attempt, and then selecting the attempt that yields the highest recognition confidence, such a process would add too much time to the recognition process to be practical. Although computing power increases every year, because users prefer to use the additional computing power to process images of higher resolution rather than improve the accuracy of the recognition, making several attempts at recognizing an image could take too long to be useful.

What is needed is a method and apparatus that can optimally set the parameters of an optical recognition without significantly adding time to the recognition.

Summary of Invention

A method and apparatus receives a digitized representation of an image at a first resolution, then produces a lower resolution version of the image. The method and apparatus then attempts multiple recognitions on the reduced-resolution version of the image using different parameters for each recognition and records the confidence level of the attempt. The parameters that yielded the highest confidence level on the attempt using the lower

resolution version can then be used to perform the recognition on the higher-resolution version of the image.

Brief Description of the Drawings

Figure **1** is a block schematic diagram of a conventional computer system.

Figure **2** is a block schematic diagram of a system for identifying optimal parameters for optical object recognition according to one embodiment of the present invention.

Figure **3** is a flowchart illustrating a method of identifying optimal parameters for optical object recognition according to one embodiment of the present invention.

Detailed Description of a Preferred Embodiment

The present invention may be implemented as computer software on a conventional computer system. Referring now to Figure **1**, a conventional computer system **150** for practicing the present invention is shown. Processor **160** retrieves and executes software instructions stored in storage **162** such as memory, which may be Random Access Memory (RAM) and may control other components to perform the present invention. Storage **162** may be used to store program instructions or data or both. Storage **164**, such as

a computer disk drive or other nonvolatile storage, may provide storage of data or program instructions. In one embodiment, storage **164** provides longer term storage of instructions and data, with storage **162** providing storage for data or instructions that may only be required for a shorter time than that of storage **164**. Input device **166** such as a computer keyboard, mouse, scanner, digital camera or any or all of these allows user input to the system **150**. Output **168**, such as a display or printer, allows the system to provide information such as instructions, data or other information to the user of the system **150**. Storage input device **170** such as a conventional floppy disk drive or CD-ROM drive accepts via input **172** computer program products **174** such as a conventional floppy disk or CD-ROM or other nonvolatile storage media that may be used to transport computer instructions or data to the system **150**. Computer program product **174** has encoded thereon computer readable program code devices **176**, such as magnetic charges in the case of a floppy disk or optical encodings in the case of a CD-ROM which are encoded as program instructions, data or both to configure the computer system **150** to operate as described below.

In one embodiment, each computer system **150** is a conventional Intel Pentium/Celeron compatible computer such

as the model 6540C commercially available from Hewlett Packard Corporation of Palo Alto, California, running the Windows operating system commercially available from Microsoft Corporation of Redmond Washington, although other systems may be used.

Referring now to Figure **2** a system for identifying optimal parameters for optical object recognition is shown according to one embodiment of the present invention. The description below uses characters as the objects, however, objects can be shapes, people, three-dimensional items or any other object. Native resolution image storage **210** receives at input **208** a digitized representation of an image from an optical scanning device such as a scanner or digital camera at input **208**. Native resolution image storage **210** contains conventional memory such as random access memory or other types of storage and stores the digitized representation of the image in this storage. As native resolution image storage **210** receives an image, it signals downsampler **212**.

In one embodiment, the digitized representation of the image stored in native resolution image storage **210** is made up of an array of pixels at a resolution. For example, the digitized representation of the image may be represented

with a resolution of 1200 x 1200 pixels per inch. Thus, an 8.5 by 11 inch document may be represented by 134,640,000 pixels. The digitized representation of the image may be stored using conventional compression techniques, so the number of pixels stored in native resolution image storage **210** may be less than the 134,640,000 pixels for that size document, even though that many pixels are represented by the digitized representation of the image. Each of the pixels may have one or more values. A greyscale image may have a greyscale value. A color image may have a pair of values: one representing luminance or intensity, and another value representing chromiance or color.

Downsampler **212** retrieves the digitized representation of the image from native resolution image storage **210**, reduces the resolution, and stores the result into low resolution image storage **214**. Downsampler **212** reduces the resolution by selecting a set of pixels, computing an average representation of the value or values of the pixels in the set, and then representing the entire set of pixels selected by a single pixel (or a number of pixels fewer than the number of pixels in the set) having the average value or values of the set of pixels selected. If the digitized representation of the image is compressed, downsampler **212** decompresses the image before reducing the

resolution and may optionally compress the result prior to storage into low resolution image storage **214**.

For example, if the resolution is 1200 dpi and it is desired to reduce the resolution to 300 dpi, downsampler **212** selects from native resolution image storage **210** a set of sixteen pixels from the upper left hand corner of the image, four pixel columns wide and four pixel rows tall, and averages the values from these pixels to produce a single pixel, which is output to low resolution image storage **214**. Low resolution image storage **214** contains conventional storage such as memory or disk storage. The four pixels adjacent to these in each of the same four rows are selected and the process is repeated by downsampler **212** and so on until the end of the row is reached. When the end of the row is reached, downsampler **212** selects the next four rows and repeats the process described above for these rows. It isn't necessary to proceed step-by-step in this fashion, nor is it necessary to average the values. For example, the values may be smoothed using conventional smoothing techniques. When downsampler **212** has completed reducing the resolution of the digitized representation of the image, downsampler **212** signals parameter selector **220**.

Parameter selector **220** selects an initial set of one or more parameters and passes them to recognition engine **216**. Recognition engine is any conventional recognition engine such as an optical character recognition engine that can accept a set of parameters, identify a segment of an image, and provide the one or more characters recognized at the highest confidence level and also supply that confidence level, which may be a value between 0 and 1. Recognition engine **216** performs conventional optical character recognition techniques using the parameters provided by parameter selector **220** on the reduced resolution version of the digitized representation of the image that is stored in low resolution image storage **214**. In one embodiment, recognition engine **216** segments the image into characters or words and then attempts to recognize the character or word using conventional optical character resolution techniques on each segment. Optical character recognition is described in Bunke & Wang, ed., *Handbook of Character Recognition and Document Image Analysis* (1997 World Scientific Publishing Co. Pte. Ltd, Singapore, ISBN 981-02-2270-X). Other forms of object recognition may also be used such as handwriting recognition, described in S Impedoio and J Simon, eds. *From Pixels to Features III*" (1992 Elsevier Science Publishers,

B.V., Amsterdam). Source code for an optical character recognition engine is publicly available from the National Institute of Standards and Technology, Gaithersburg, Maryland, 20899 and is described in Garris et al, "Public Domain Optical Character Recognition", *Proceedings, SPIE* Volume 2422, pp2-15, and this engine may be suitably modified as described herein.

Parameter selector **220** selects another set of parameters and passes them to recognition engine **216** and signals recognition engine to repeat the recognition process described above on the same segment of the image it just processed, and recognition engine **216** complies with the request. This process may be repeated a number of times, each time with a different set of parameters.

In one embodiment, each time another set of parameters is selected and provided by parameter selector **220**, the value of only one of the parameters is varied until several different values of that parameter have been selected and provided to recognition engine **216** by parameter selector **220**. When all possible values of that parameter have been provided or when an acceptable value has been identified, that parameter is set to a particular value and the value

of a different parameter is varied, and so forth until all the parameters have been varied.

For example, assume two parameters, parameter 1 and parameter 2, with possible values of A1, B1, C1 and D1 for parameter 1 and values A2 and B2 for parameter 2. The sets of parameters provided by parameter selector **220** could be (A1, A2), (B1, A2), (C1, A2), (D1, A2), (A1, B2), (B1, B2), (C1, B2), (D1, B2).

It is not necessary to provide all possible values: for example, a binary search technique may be used or a discrete set of parameter combinations may be provided with multiple parameters changing from one set of parameters to the next. For example, the parameter values provided by parameter selector **220** could be limited to (A1, A2), (B1, B2), (C1, A2), (D1, B2).

Each time the parameters are provided to recognition engine, parameter selector **220** provides those parameters or an indicator of the parameters to optimal parameter identifier **222**. In addition, recognition engine provides the confidence level of the character recognition to optimal parameter identifier. Optimal parameter identifier **222** records the parameters and the confidence level so that the optimal value for the parameters may be identified by

selecting values of parameters that yield the highest confidence levels.

In one embodiment, optimal parameter identifier identifies the optimal value for a parameter by choosing the value of a parameter that yielded the highest confidence level for the recognition performed by recognition engine **216**. In another embodiment, if the confidence level exceeds a threshold, such as 0.95, optimal parameter identifier **222** signals parameter selector **220** to select no further values of that parameter. This way, if an acceptable value is reached, the system **200** does not continue searching for a better one: the acceptable value is used as the optimal value.

In one embodiment, when an optimal value for a particular parameter has been identified, optimal parameter identifier **222** provides the value of the optimal parameter to parameter selector **220** to use in all remaining parameter selections it makes as described above. In another embodiment, a preset value may be used in place of the optimal parameter for use in attempting to identify the optimal value of a different parameter.

When the optimal values of all of the parameters have been identified as described above, optimal parameter

identifier **222** signals recognition engine with the optimal values of all parameters. Recognition engine **216** selects the segment of the digitized representation of the image in native resolution image storage **210** that corresponds to the segment in low resolution image storage **214** that was used to select the optimal parameters and performs an optical character recognition of the segment from native resolution image storage **210**. In one embodiment, recognition engine **216** uses the same character recognition techniques that it used on the lower resolution version of the image to recognize the higher resolution version of the image. In another embodiment, a different character recognition is used for the different resolution versions of the image. In one embodiment, when recognition engine completes the optical character recognition of the higher resolution image, it outputs at output **218** a representation of the object or objects recognized and signals parameter selector **220** so that the process may be repeated on a different segment of the image. The representation of the object or objects recognized may be an ASCII character as well as font descriptions and the like or may be a code for a particular object, such as a rubber band or a circle. In another embodiment, recognition engine **216** attempts to recognize the next segment from native resolution image

storage **210** using the same parameters as the last segment, and only signals parameter selector **220** to begin the process of parameter selection again if the confidence level of the recognition for the segment falls significantly below the confidence level of the last recognition or falls below a certain preset value.

Referring now to Figure **3**, a method of identifying optimal parameters for optical object recognition is shown according to one embodiment of the present invention. The description below uses characters as objects, but an object may also be noncharacter things as described above. An digital representation of an image is received and stored **310** at a first resolution, such as a native resolution of a scanning device as described above. A reduced-resolution version of some or all of the image received in step **310** is produced and stored **312** as described above. A segment is selected **314**, either from the image received in step **310** or the version of the image produced in step **312**. An initial set of parameters are selected **316** as described above. An attempt is made to recognize one or more objects such as characters in the segment from the reduced resolution version of the image, and the highest confidence level obtained from the attempt is produced **318**. If there are additional combinations of parameters **320**, a different

combination is selected as described above **322** and the method continues at step **318** using the different combination of parameters. When the selection and testing the recognition from the combinations of parameters is completed as described above **320**, the optimal parameters are identified **324** as described above. The segment of the image received in step **310** is then recognized using the optimal parameters **326** and the character or characters recognized from the segment of the image received in step **310** are output **326**. If there are more segments **328**, the next segment is selected **330** and the method continues at step **316** using the selected segment, and otherwise, the method terminates **332**.

In an alternate embodiment of the present invention illustrated by the dashed lines in the figure, when the next segment is selected at step **330**, instead of continuing at step **316**, the method continues at step **340**. At step **340**, the segment from the digitized representation of the image received in step **310** is recognized and a confidence level is identified. If the confidence level is acceptable as described above **342**, the character or characters recognized in step **340** are output and the next segment is selected **344**, and the method continues at step **340**. Otherwise **342**, the method continues at step **316** to identify

values of parameters to use for the segment on which the recognition was attempted in step **340** but acceptable recognition confidence was not achieved.

What is claimed is:

1. A method of recognizing at least one object in a digitized representation of an image, comprising:

receiving the digitized representation of the image, the representation having a first resolution;

creating a reduced-resolution version of the image responsive to the digitized representation of the image, the reduced-resolution version of the image having a second resolution lower than the first resolution; and

identifying a value of each of at least one recognition parameter using the reduced resolution version of the image; and

recognizing the at least one object represented in the digitized representation of the image responsive to the value of each of the at least one recognition parameter identified.

2. The method of claim 1 wherein the identifying step comprises:

providing a plurality of sets of values of at least one parameter;

for each of the sets of at least one parameter, identifying a confidence level of recognition by attempting

to recognize from the reduced-resolution version of the image the at least one object responsive to the at least one parameter in the set; and

selecting at least one of the values of the at least one parameters in the set responsive to the confidence levels identified.

3. The method of claim 2 wherein the selecting step comprises selecting a value of each of at least one parameter corresponding to a highest confidence level from a plurality of the confidence levels identified.

4. The method of claim 2 wherein the selecting step comprises selecting a value of each of at least one parameter corresponding to a confidence level exceeding a threshold.

5. The method of claim 1 wherein the creating step comprises calculating an average of at least one value of a plurality of pixels of the digitized representation of the image.

6. The method of claim 1 additionally comprising recognizing at least one additional object represented in the digitized representation of the image responsive to the value of at least one recognition parameter identified responsive to a confidence level exceeding a threshold.

7. The method of claim 1 additionally comprising:

attempting to recognize at least one additional object represented in the digitized representation of the image responsive to the value of at least one recognition parameter identified, the attempting step comprising producing a confidence level of the attempt; and

responsive to the confidence level of the attempt below a threshold:

repeating the identifying step; and

recognizing the at least one object represented in the digitized representation of the image responsive to the value of each of the at least one recognition parameter identified during the repeating step.

8. A computer program product comprising a computer useable medium having computer readable program code embodied therein for recognizing at least one object in a digitized representation of an image, the computer program product comprising:

computer readable program code devices configured to cause a computer to receive the digitized representation of the image, the representation having a first resolution;

computer readable program code devices configured to cause a computer to create a reduced-resolution version of the image responsive to the digitized representation of the image, the reduced-resolution version of the image having a second resolution lower than the first resolution; and

computer readable program code devices configured to cause a computer to identify a value of each of at least one recognition parameter using the reduced resolution version of the image; and

computer readable program code devices configured to cause a computer to recognize the at least one object represented in the digitized representation of the image responsive to the value of each of the at least one recognition parameter identified.

9 The computer program product of claim 8 wherein the computer readable program code devices configured to cause a computer to identify comprises:

computer readable program code devices configured to cause a computer to provide a plurality of sets of values of at least one parameter;

computer readable program code devices configured to cause a computer to, for each of the sets of at least one parameter, identify a confidence level of recognition by

attempting to recognize from the reduced-resolution version of the image the at least one object responsive to the at least one parameter in the set; and

select at least one of the values of the at least one parameters in the set responsive to the confidence levels identified.

10. The computer program product of claim 9 wherein the computer readable program code devices configured to cause a computer to select comprise computer readable program code devices configured to cause a computer to select a value of each of at least one parameter corresponding to a highest confidence level from a plurality of the confidence levels identified.

11. The computer program product of claim 9 wherein the computer readable program code devices configured to cause a computer to select comprise computer readable program code devices configured to cause a computer to select a value of each of at least one parameter corresponding to a confidence level exceeding a threshold.

12. The computer program product of claim 8 wherein the computer readable program code devices configured to cause a computer to creating comprise computer readable program code devices configured to cause a computer to

calculate an average of at least one value of a plurality of pixels of the digitized representation of the image.

13. The computer program product of claim 8 additionally comprising computer readable program code devices configured to cause a computer to recognize at least one additional object represented in the digitized representation of the image responsive to the value of at least one recognition parameter identified responsive to a confidence level exceeding a threshold.

14. The computer program product of claim 8 additionally comprising:

computer readable program code devices configured to cause a computer to attempt to recognize at least one additional object represented in the digitized representation of the image responsive to the value of at least one recognition parameter identified, the computer readable program code devices configured to cause a computer to attempt comprising computer readable program code devices configured to cause a computer to produce a confidence level of the attempt; and

computer readable program code devices configured to cause a computer to, responsive to the confidence level of the attempt below a threshold:

repeat the identifying step; and

recognize the at least one object represented in the digitized representation of the image responsive to the value of each of the at least one recognition parameter identified during operation of the computer readable program code devices configured to cause a computer to repeat.

15. A system for recognizing objects, the system comprising:

a downsampler having an input coupled to a system input operatively coupled for receiving a representation of an image having a first resolution, the downsampler for producing and providing at an output a reduced-resolution version of the image responsive to the representation of the image received at the downsampler input, the reduced resolution version of the image having a second resolution lower than the first resolution; and

a recognition engine having a first input coupled to the downsampler output for receiving the reduced-resolution version of the image and a second input coupled to the system input for receiving the representation of the image, the recognition engine for:

at least attempting to recognize at least one first object in the reduced resolution version of the image received at the first input, at least one time;

recognizing at least one second object in the representation of the image received at the second input; and

providing a representation of the at least one object recognized at a first output coupled to a system output.

16. The system of claim 15 wherein:

the system additionally comprises a parameter selector for selecting and providing at an output a plurality of sets of parameters, each set different from at last one of the other sets; and

the recognition engine additionally has a third input coupled to the parameter selector output for receiving the plurality of sets of parameters and the recognition engine performs the attempt on the at least one object at least one time for each of the sets of parameters received at the third recognition input.

17. The system of claim 16:

wherein the recognition engine:

additionally has a fourth input for receiving an additional set of parameters;

performs the recognizing responsive to the additional set of parameters;

is additionally for providing a recognition confidence level at a second output responsive to said attempt, for each of the at least one times; and

the system additionally comprising a parameter identifier having a first input coupled to the recognition second output for receiving the recognition confidence level for each of the at least one times, and a second input coupled to the parameter selector output for receiving each of the sets of parameters, the parameter identifier for selecting and providing at an output coupled to the fourth recognition engine input the additional set of parameters responsive to the sets of parameters received at the parameter identifier second input and the recognition confidence level for each of the at least one times received at the parameter identifier first input.

18. The system of claim 17 wherein the parameter identifier selects the additional set of parameters additionally responsive to a threshold confidence level.

19. The system of claim 17 wherein:

the at least one time comprises a plurality of times; and

the parameter identifier selects the additional set of parameters responsive to a confidence level for at least one of the at least one times relative to at least one other confidence level for at least a different of the at least one times.

20. The system of claim 20 wherein the recognition engine additionally recognizes at least one third object in the representation of the image received at the second input responsive to the additional set of parameters and a confidence level corresponding to the at least one third object.

Abstract of the Disclosure

A method and apparatus creates a reduced-resolution version of an image and uses the reduced resolution version to identify recognition parameters. The recognition parameters are then used on the original version of the image to recognize objects such as characters in the image.

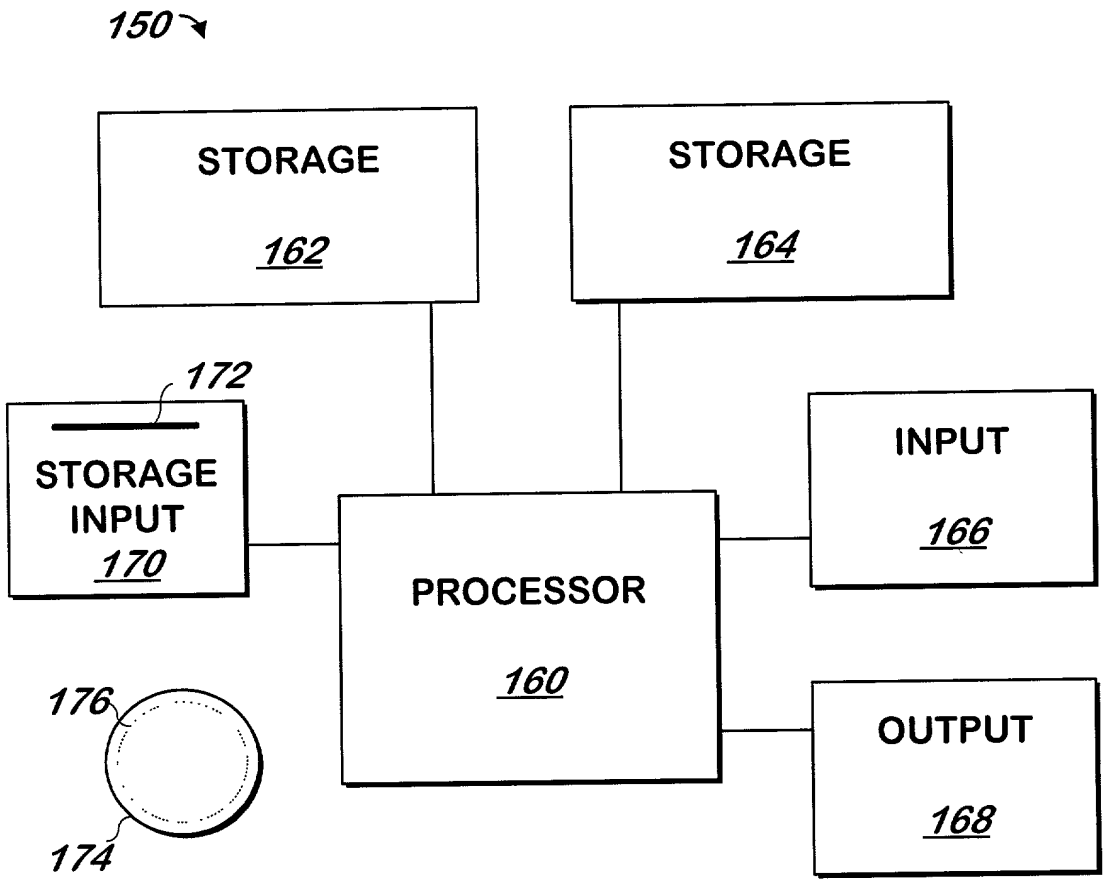

FIG. 1
(PRIOR ART)

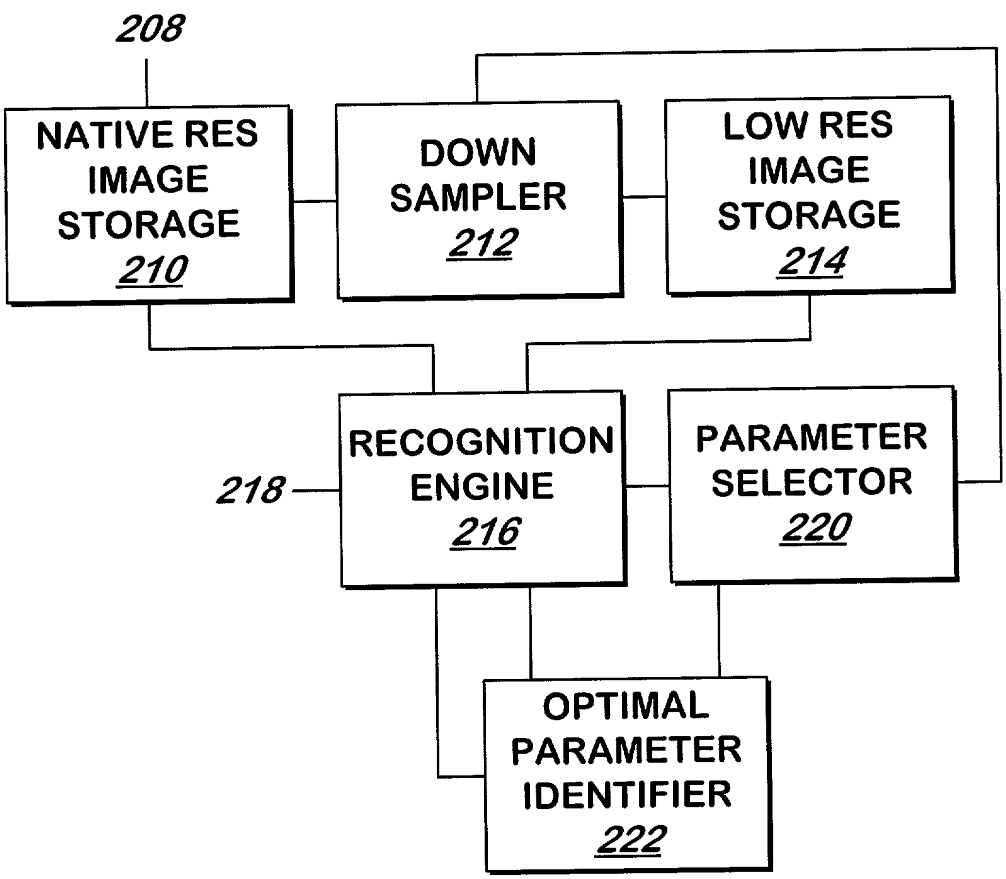
208
NATIVE RES IMAGE STORAGE 210
DOWN SAMPLER 212
LOW RES IMAGE STORAGE 214
218
RECOGNITION ENGINE 216
PARAMETER SELECTOR 220
OPTIMAL PARAMETER IDENTIFIER 222

FIG. 2

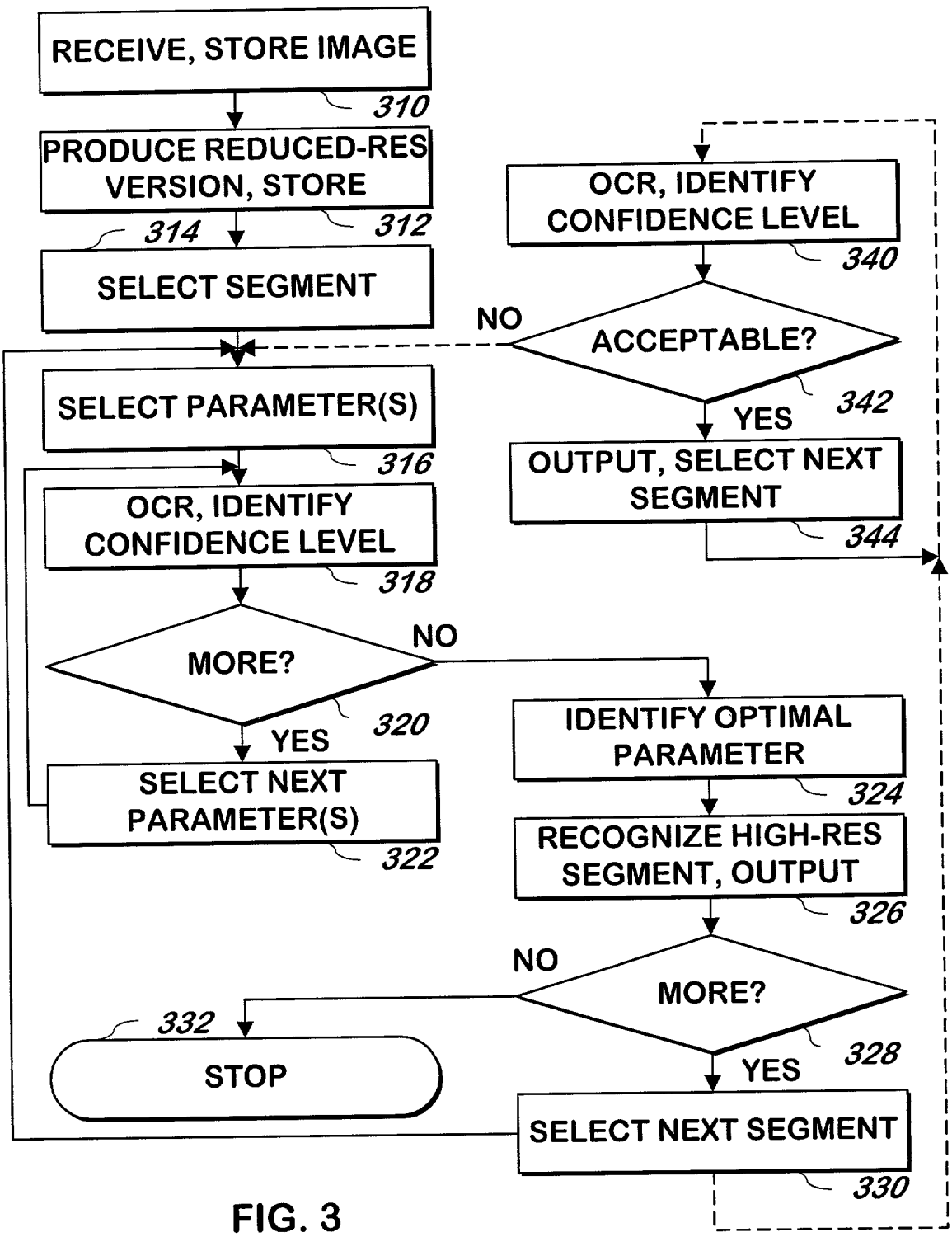
RECEIVE, STORE IMAGE
310
PRODUCE REDUCED-RES VERSION, STORE
312
314
SELECT SEGMENT
SELECT PARAMETER(S)
316
OCR, IDENTIFY CONFIDENCE LEVEL
318
MORE?
320
YES
SELECT NEXT PARAMETER(S)
322
NO
332
STOP
OCR, IDENTIFY CONFIDENCE LEVEL
340
ACCEPTABLE?
342
NO
YES
OUTPUT, SELECT NEXT SEGMENT
344
IDENTIFY OPTIMAL PARAMETER
324
RECOGNIZE HIGH-RES SEGMENT, OUTPUT
326
MORE?
328
NO
YES
SELECT NEXT SEGMENT
330

FIG. 3

Type a plus sign (+) inside this box -> [+]

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DECLARATION

[X] Declaration Submitted with Initial Filing OR [ ] Declaration Submitted after Initial Filing

Attorney Docket Number	1151
First Named Inventor	Kishan B. Shah
COMPLETE IF KNOWN	
Application Number	
Filing Date	8/7/2000
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled .

METHOD AND APPARATUS FOR EFFICIENT DETERMINATION OF RECOGNITION PARAMETERS

(Title of the Invention)

the specification of which

[X] is attached hereto

OR

[ ] was filed on MM/DD/YYYY [ ] as United States Application Number or PCT International Application Number [ ] and was amended on (MM/DD/YYYY) [ ] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37 Code of Federal Regulations, 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code § 119 (a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application for which priority is claimed.

Prior Foriegn Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Copy Attached? Yes	Copy Attached? No
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]

[ ] Additional foreign application numbers are listed on a supplemental priority sheet attached hereto:

I hereby claim the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

Application Number(s)	**Filing Date (MM/DD/YYYY)**	
		[ ] Additional provisional application numbers are listed on a supplemental priority sheet attached hereto

DECLARATION

I hereby claim the benefit under Title 35, United States Code § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code § 112. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number *(if applicable)*

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority sheet attached hereto.

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

Firm Name Law Offices of Charles E. Gotlieb **Payor Number** (if applicable) 526-59-8207

Name	Registration Number	Name	Registration Number
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☒ Additional attorney(s) and/or agent(s) named on a supplemental sheet attached hereto.

☒ Please direct all correspondence to. **Name** Charles E. Gotlieb

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name Kishan **Middle Initial** B **Family Name** Shah **Suffix**

Inventor's Signature Kishan Shah **Date** 08/03/2000

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☐ Additional inventors are being named on supplemental sheet(s) attached hereto

DECLARATION

ATTORNEY and/or AGENT INFORMATION
(Supplemental Sheet)

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